Malcolm Morgan Marine / M³
Marine Electrical, Corrosion & Engineering Services

Limited Corrosion / Electrical / Shore Power Inspection
Honokohau Small Craft Harbor
May / June 2017

Malcolm Morgan 415-304-7938
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Important - Please Read Carefully - Our services are not a guarantee against corrosion or shock hazards.

As per your request we have completed an inspection of the berths described above. The findings and recommendations are attached. Please note that no guarantees are made as to the integrity of the harbor wiring, vessels, or the systems described here-in. We offer a careful inspection, and an expert opinion, but not every system or component has been inspected, and any system or components that have been inspected may be subject to future wear and tear or failure that could pose a safety concern. Conditions in the marine environment change constantly, and there is no guarantee that an underlying problem or condition[s] exist, that was not apparent at the time of the inspection[s]. The attached recommendations (if any) are intended to reduce or mitigate known problems, but are in NO way a guarantee against corrosion or safety issues.

Regular testing and maintenance is required to ensure a safe, reliable electrical system.

Statement Regarding Conflict of interest:

The process of reducing or eliminating shock hazards and corrosion often requires specialized equipment or components. Unlike most Marine Surveyors, we are also in the business of selling equipment, and / or making repairs to vessel systems. In order to remove any potential conflict of interest, Malcolm Morgan Marine / M^3 does not make any solicitations, or engage in selling equipment or other services to electrical inspection clients. Whenever possible, other vendors, installers, or sources of equipment will be suggested. There are some cases where we may be the only source of the item[s] suggested, as we have had to invent several systems in-house, where no other feasible solutions previously existed. In addition, we distribute a complete line of corrosion control equipment, as we strive to offer the best solutions to corrosion problems.

Inspector's statement :

In the process of performing the function of testing and evaluating the electrical system in a marina, there will inevitably be discoveries that lead to expensive repairs, upgrades, or additional equipment. It is not the intent of these findings to attack the integrity of the Harbor Staff, personnel, contractors, or any individuals. We have been retained to carefully investigate potential flaws that could affect the long term use, safety, and integrity of the marina. If it appears that the findings are critical, it is because we are thorough, and have many years of experience. The resulting findings and recommendations represent an unbiased version of the facts, not prejudiced in any way. The intent of the recommendations listed is to address any safety issues, and hopefully attain a long service life of the components mentioned in the report, with a reasonable amount of periodic maintenance.

Limited report: Only the items mentioned in this report have been tested or inspected. It is beyond the scope of our services to fully evaluate all aspects of the entire property. **This limited inspection is intended only to address the specific complaints mentioned in the report.**

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Test Methods:

The shore power polarity / volt drop / impedance test uses a digital hand-held tester, plugged into the shore power receptacle and a test pulse is sent to the neutral and ground wires. This checks several critical parameters on the harbor's shore power supply circuit. The first item tested is ***reversed polarity*** of the wiring in the receptacle. Next, the tester checks and displays the ***voltage drop under load***, and the ***impedance*** or ***quality*** of the receptacle power and safety ground wire connections. Finally, the tester checks the ***voltage difference*** between the neutral and ground wires. For these tests, the polarity indicator lights should activate, the voltage drop under load should be less than 5%; the maximum impedance of each of the wires should be below 0.25ohm; and the maximum difference between neutral and ground should be below 0.25 VAC.

The Ground Fault / Arc Fault test uses a hand-held tester that sends a calibrated test pulse to ground, to test the operation of GFCI or AFCI breakers if the harbor shore power system uses these type of breakers. For these tests, the breaker should 'hold' at a test pulse below the trip rating, but should trip at any test current above the trip threshold.

The ground wire potential test uses a mil-spec zinc reference cell immersed in the water, connected to a digital millivolt meter and readings are taken relative to the harbor's shore power receptacle ground wire. This indicates if there are any potentially hazardous voltages on the harbor ground wire that may be applied to the boat's underwater fittings when connected to shore power. For this test, readings between 100 –600 millivolts are considered typical for most harbors. Readings below this range could possibly indicate a problem with the harbor ground system; readings above this range could indicate a nearby boat or boats with poor wiring or severely inadequate anode protection.

The harbor stray current test uses a floating test probe with two reference cells immersed in the water to check the berth area for lines of stray current in the water around the vessel. Tests are made in both AC and DC modes, in two perpendicular directions at the surface of the water; typically in both the North / South direction, then in the East / West direction.

For this test, readings of 25 millivolts or less are considered normal. Readings over this amount could indicate a source of electricity leaking into the water, from either a nearby vessel, or from the harbor shore power system.

The vessel shore power leak test uses a sensitive amp clamp to search for a loss of current, or leak into the water. If the amp clamp reading around the shore power cord is zero, then all of the current flowing into the vessel via the shore power cord is being returned via the shore power cord. If the amp clamp detects a current difference between the shore power wires, it then indicates that current on the shore power wires is not equal, and the most likely alternate return current path is into the water surrounding the vessel. For this test, a reading of only 30 milliamps AC or higher is considered a safety hazard. Higher readings could pose a serious shock hazard to divers or swimmers near the vessel, and require immediate attention. For DC leak currents, the primary concern is for corrosion damage, as damage can occur in a very short time.

The "Buzz" test is a preliminary test using a portable scanner fitted with a sensitive receiver to detect the presence of an AC leak in or around the dock wiring. The scanner is 'swept' in a zigzag pattern along the dock or conduit in question, and an audio signal changes tone when in the vicinity of an AC stray current. For this test, the results are 'Pass' or 'fail'. Further testing using other methods are used to verify suspect areas and quantify actual readings.

Water chemistry tests use sensitive pH, conductivity, salinity, and TDS meters to determine the overall conductivity of the water . Different water chemistry determines the type of anodes needed.

<end, test methods>

IMPORTANT - THIS IS A LIMITED INSPECTION
Only the areas mentioned in this report have been inspected. No inspections were made in inaccessible areas. Only random spot checks were made aboard the moored vessels. The electrical cabinets were not disassembled for inspection. It is beyond the scope of this inspection to evaluate all parts of this property. Additional inspections by qualified personnel may be required.
Several items need immediate attention to reduce the risk of imminent fire & shock hazards.

Background / Complaint:

Malcolm Morgan Marine / M³ was retained by the DLNR / marina manager to inspect the dock shore power system, review testing procedures, advise on shock hazards and NEC / NFPA code compliance issues. Visual inspections, stray current tests, and load tests were performed to check the electrical system.
The ABYC (American Boat and Yacht Council) standards, NEC (National Electric Code) NFPA (National Fire Prevention Association) and other industry - accepted standards were referenced in conducting these tests and preparing this report.

Summary / Site Description:

1. Mixed use private & commercial marina with boat docks, dry storage, and large bar and grill building, located on the West side of the Island of Hawaii.
2. "No Swimming" signs are not posted at any of the gates or entrances. Public access controlled in some areas by locked privately - owned gates; most docks and landings are ungated.
3. The overall condition of the electrical infrastructure appears to be in poor, neglected condition, and presents a clear and present danger of fire or accidental electrocution.
4. The coin-operated pedestals are in great disrepair, many still energized. Shock and fire hazard.
5. Fixed (non-floating) concrete causeways form the docks within the marina. The dock-mounted shore power pedestals are not equipped with GFI breakers as required by NEC article 555. Non code-compliant, possible shock hazard, further action recommended.
6. A mixture of fixed (non-floating) wooden landings and concrete walkways surround the marina. Most of the vessel tie-up sites have non-standard owner-installed shore power receptacles and are not equipped with GFI breakers as required by NEC article 555. Non code-compliant, possible shock hazard, further action recommended.
7. Many of the owner-installed shore power receptacles do not meet the minimum height requirements of NFPA 303 standard. (12" above the deck AND 30" above water level) Non code-compliant, possible shock hazard, further action or regular inspections required.
8. The entire dock lighting system is in a state of disrepair; the below-deck junction boxes are submerged at high tide. Non code-compliant, severe shock hazard, further action recommended.
9. The primary Service Entrance Panel equipment appears to date from 1970's but appears to be in serviceable condition. The main ground rod connection was found loose and corroded but was temporarily repaired during the inspection.
10. Several vessels were discovered using undersize, worn, or damaged household extension cords for shore power. Possible fire hazard, further action required.
11. Water salinity varies greatly from fresh, to saline depending on runoff from upslope areas. This greatly increases the risk of electrocution to swimmers or divers in the water near the vessels when the fresh water is present. When the salt water returns, the risk of shock in the water is reduced, but the risk of electrical shock or fire on board a vessel increases; if an electrical fault was to occur.

MPOE / South Side Utility Shed - Electrical Findings:

1. The Main ground rod was found corroded and the clamp connecting the Equipment Grounding Conductor (EGC) was loose. Further action required.
2. The other two ground clamps were found slightly corroded. Further action required.
3. AC leak current at the main ground rod was tested at 85 ~ 91 milliAmps (mA) Very low leak current.
4. Equipment does appear to meet the minimum height requirements of Electrical Datum Plane (24" above highest tide level).
5. Main disconnects not clearly labeled on outside of building. Further action required.
6. "No Swimming" signs not posted at any of the marina entrances. Further action required.

Coin - Operated Shore Power Pedestals - Electrical Findings:

1. All of the coin - operated pedestals are in serious disrepair, and do not appear to have any over-current protection (circuit breaker). Pedestals are numbered as indicated on the attached harbor plan. Pedestals #4,5,7,8,9,10,11,12,17,18,19 are still energized & show evidence of tampering or vandalism. Imminent shock and fire hazard. Further action required.
2. Several of the pedestals are fed via conduits from the adjacent utility poles; conduits are broken, separated and torn loose from their mountings. Further action required.
3. The pedestal on the N/W end of the line on the North side of the marina is supplying several different vessels, all using undersized, household extension cords. Some of the cords travel great distances and join other cords in deteriorated condition. Possible arcing, fire, shock hazard.

Dock Lighting System - Electrical Findings:

1. Junction boxes are located on fixed (non floating) concrete causeways, do not meet the minimum height requirements of the Electrical Datum Plane. Non - waterproof splices used, signs of water intrusion was noted in every junction box that was inspected. Due to the presence of both salt and fresh water in this marina, this presents an imminent electrocution hazard, as well as a possible fire hazard. Further action required.
2. The dock lighting system is not equipped with GFCI protection. Does not meet code.

Fuel Dock Building / Steel Crane - Electrical Findings:

1. Steel crane power supply wiring noted with very deteriorated / broken conduit fittings, exposed wiring, in close proximity to public access area for sportfishing / diving charter guests. Due to the high foot traffic and presence of both salt and fresh water in this marina, this presents an imminent electrocution hazard, as well as a possible fire hazard. Further action required.
2. 120VAC receptacle on the patio at the S/W corner of the crane deteriorated, broken loose from mountings, not GFCI equipped. Possible shock hazard, Does not meet code.
3. None of the 120VAC receptacles in any of the bathrooms on the South side of the marina are GFCI equipped. Non code compliant. Possible shock hazard. Further action required.

Harbor House Restaurant - Electrical Findings:

1. None of the 120VAC receptacles in the East and West bar areas are GFCI equipped. Non code compliant. Possible shock hazard. Further action required.
2. The electrical equipment that was accessible for inspection on the outside of the building does appear to meet the requirements of the Electrical Datum Plane (24" above high tide level)

Private Vessel Landings - Electrical Findings:

Nearly ALL of the private vessel landings are poorly wired, with numerous code and safety violations. Attempts were made to test and document all of the receptacles at each landing but access was restricted in some cases by locked gates, and some areas were inaccessible for testing. Additional inspections are still required to fully asses the condition of the electrical system in these areas. Receptacle tests were made as shown in the "test methods" section at the beginning of this report. Vessel AC leak current tests were performed on all vessels connected to shore power to check for the presence of any AC leak current escaping into the water through the vessel's electrical system. In SALT water marinas the normal maximum allowable threshold is 100mA (1/10th of one amp AC) In FRESH water marinas the normal maximum allowable threshold is 30mA (1/30th of one amp AC) Several vessels in the marina indicated much higher readings; this coupled with the presence of fresh water can create a severe shock hazard around the vessel. Follow-up testing of suspect vessels is usually warranted to determine the fault circuit(s).

1. Private landing #40 - household extension cords used to power several different items, one of the GFCI receptacles indicated very weak ground connection. Possible shock hazard, further action required.
2. Private landing #38 - household extension cord used for vessel power; high (+10%) voltage drop test. Possible fire hazard, further action required.
3. Private landing #34 vessel "Gutsy Lady" - using household dryer outlet in lieu of proper marine 30A twist-lock receptacle. Numerous items hard wired with household Romex cable, 120VAC receptacle test indicated weak or missing ground. Non code compliant, possible fire hazard. Further action required.
4. Private landing #32.5 - very high voltage drop test (+38%) Possible arcing, fire hazard. Further action required.
5. Private landing #32 - vessel "Northern Lights" AC leak test indicated high (+265milliAmps) leak current to water. Possible shock hazard. Retest to determine if further action required.
6. Private landing #30.5 - vessel "Sun Seeker" 2 x 50A shore cords, cord on left side very corroded, Cord #1 AC leak test indicated high (+150mA) leak current to water. Cord #2 AC leak test indicated very high (+500mA) leak current to water. Possible shock hazard. Retest to determine if further action required. Possible shock hazard. Retest to determine if further action required.
7. Private landing #29 - vessel "Blue Hawaii" AC leak test indicated very high (865mA) leak current to water. Vessel equipped with "Iso Boost" isolation transformer, suspect vessel wiring issue. Possible shock hazard. Retest to determine if further action required.
8. Private landing #12 - Very weak or no ground connection at receptacle. Shock hazard, further action required.
9. Private landing #11 - AC leak test indicated high (+790milliAmps) leak current to water. Possible shock hazard. Retest to determine if further action required.
10. Private landing #10 - Household extension cord used to power vessel, cord hanging in water. Possible fire hazard, further action required.
11. Private landing #9 - Very weak or no ground connection at receptacle; high differential voltage (+.6VAC) between neutral and ground. Shock hazard, further action required. AC leak test indicated high (+630milliAmps) leak current to water. Possible shock hazard. Retest to determine if further action required.

Marina / Concrete Causeway Receptacles - Electrical Findings:

1. Berth J28 - deteriorated receptacle, no power, unable to determine cause. Further action recommended.
2. Berth J25 - deteriorated receptacle, circuit breaker bypassed. Tests indicated high (+.35ohm) impedance on ground wire. Vessel AC leak test indicated high (+268mA) leak current. Possible fire, shock hazard. Further action required.
3. Berth J37.5 - deteriorated receptacle, tests indicated high Very weak or no ground connection at receptacle; high differential voltage (+.4VAC) between neutral and ground; (+.38ohm) impedance on ground wire. Shock hazard, further action required.
4. Berth H7 vessel “Strong Persuader” - vessel AC leak test indicated high (+735mA) leak current. Possible shock hazard. Retest to determine if further action required.
5. Berth H4 vessel “Nasty Habit” - vessel AC leak test indicated high (+760mA) leak current. Possible shock hazard. Retest to determine if further action required.
6. Berth H16.5 - deteriorated shore power cord, missing boot at boat end of cord. Possible shock hazard, further action recommended.
7. Berth G25 - undersized shore power cord, not adequate for vessel. Possible shock hazard, further action recommended.
8. Berth G24 - deteriorated receptacle, tests indicated high (+7%) drop on hot wire. Undersized shore power cord, not adequate for vessel. Possible shock hazard, further action recommended.
9. Berth G22 - deteriorated receptacle, circuit breaker corroded. Tests indicated high (+11%) drop on hot wire. Possible arcing, fire hazard. Further action required.
10. Berth G21 - deteriorated receptacle, circuit breaker corroded. Tests indicated high (+10%) drop on hot wire. Possible arcing, fire hazard. Further action required.
11. Berth G20 - deteriorated receptacle, circuit breaker corroded. Tests indicated high (+16%) drop on hot wire. Undersized shore power cord, not adequate for vessel. Possible arcing, fire hazard. Further action required.

Note on recommendations:

Due to the highly deteriorated condition of the shore power system at the private vessel landings, and within the marina, it is recommended that if repairs cannot be completed due to budgetary or administrative reasons, it is better to disconnect the power to the most dangerous components until full repairs can be completed.

Corrective Action / Recommendations: (in order of priority)

A) Highly recommend to immediately disconnect power to all of the coin - operated power pedestals at the source, and remove the pedestals to prevent further tampering.
B) Highly recommend to immediately disconnect the power to all of the dock lighting circuits at the source. It may be advisable to install small, solar-powered pathway lights as a temporary solution until permanent rewiring of the lights can be completed.
C) Highly recommend to immediately disconnect the power to all of the steel gantry crane components at the source. It may be advisable to install in-line GFCI devices as a temporary solution until permanent rewiring of the crane can be completed.
D) Repair the conduits and broken hardware referenced on page 5 near the entrance to the sport-fishing building.
E) Repair the broken 120VAC receptacle at the S/W corner of the patio near the sportfishing building. Code requires GFCI receptacle with raintight cover.
F) Recommend to retain the services of a qualified electrical contractor who is familiar with the requirements of the NFPA 303 standard, to discuss the feasibility of rewiring all of the private vessel landings to bring the equipment up to current standards, and install 30mA GFCI breakers.
G) Recommend to retain the services of a qualified electrical contractor who is familiar with the requirements of the NFPA 303 standard, to discuss the feasibility of installation of GFCI breakers at each shore power pedestal. NEC allows the use of up to 100 milliamp trip breakers. If 100mA breakers are not available to fit the existing pedestals, it may be possible to use 30mA trip breakers but more nuisance tripping will likely occur.
H) Disassemble, clean and repair connections at all of the causeway pedestals referenced on page 7 and replace twist-lock receptacle and / or circuit breaker as needed. Clean all points of contact to bright, shiny metal, apply anticorrosion paste to all points of contact before reassembling connections. Retest after repairs to ensure proper readings.
I) Disassemble, clean and repair connections at both of the utility shed ground rods referenced on page 5. Clean all points of contact to bright, shiny metal, apply anticorrosion paste to points of contact before reassembly.
J) Clearly label all main disconnect switches on utility shed doors and circuit breaker cabinets for easy identification in case of emergency.
K) Replace 120V receptacles in all bathrooms with GFCI devices. Retest after repairs to verify proper voltage drop, polarity, and trip threshold.
L) Replace 120V receptacles in Harbor House restaurant kitchen / bar areas with GFCI devices. Retest after repairs to verify proper voltage drop, polarity, and trip threshold.
M) Retest all vessels referenced on pages 6 & 7 with high AC leak current readings to determine if corrective action is required. Highly recommend to adopt strict policy of 100mA maximum leak threshold for all vessels in the marina. Most vessels exceeding this limit will need to hire an ABYC certified marine electrician to correct any wiring faults and / or install an isolation transformer .

Code Compliance / General Recommendations:

A. Get a printed copy of NFPA 303 standard and keep on file in the office at all times, and start working towards compliance with the various code sections. This can be implemented in phases as time and budget allows. (available as a download from NFPA.org website)
B. Conduct periodic review of NFPA 303 with any harbor staff, outside contractors, and as new employees are hired.
C. Perform annual inspections of the electrical system to comply with NFPA 303 requirements. Keep written documentation of test results and actions taken. This can be done by an outside contractor or training can be provided to utilize your staff for this purpose.
D. Consult with the MRA or a qualified Maritime Attorney to review the existing berthholders leasing agreement. Highly recommend a periodic review of the leasing agreements to verify proper language is included that sets minimum standards for electrical safety, proper shore cords, and vessel overall maintenance.

Additional Safety Recommendations:

E. Continue to enforce a strict no swimming policy and maintain “no swimming” signs at all areas near the docks to reduce legal liability and the risk of electrocution. Exceptions can be allowed for professional divers once they have been briefed on the risks of electricity around the water, and agree to unplug the vessels before entering the water.
F. Check and verify that all shore power cords supplied by boatowners meet or exceed the current capacity of the dock pedestal breaker. IE: a 30 amp dock breaker requires a minimum #10AWG wire size to prevent a fire in the event of a malfunction on board a vessel. A 50 amp dock breaker requires a minimum #8AWG wire size for the same reasons.
G. Adopt and enforce a strict policy prohibiting the use of household extension cords for shore power. Additional documentation can be provided to send to berthholders if needed.

<end, findings and recommendations>

Main Point of Entry (MPOE) at Utility Shed on South Side of Parking Lot

All electrical connections required to be at least 24" above the maximum highest flood water level (PASS)

Panels and Enclosures Appear Serviceable Condition

Need to clearly label dock emergency shutoff breakers on outside of shed, and at each enclosure

South Side Utility Shed :

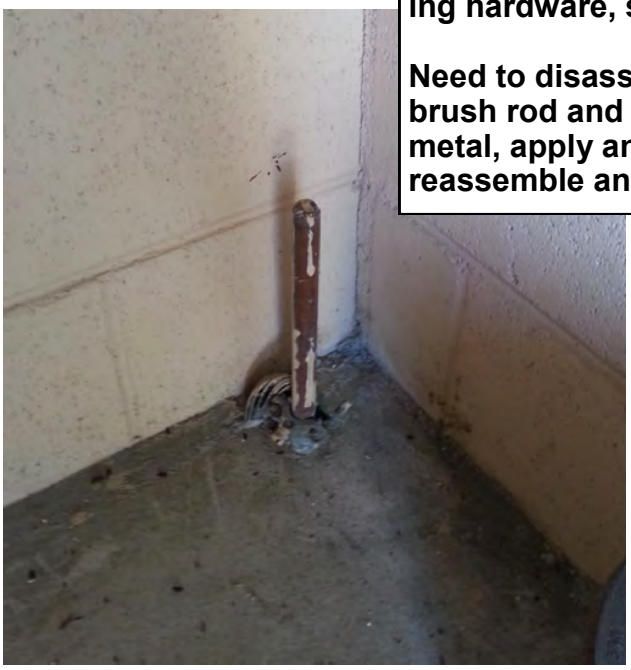
All electrical connections required to be at least 24" above the maximum highest flood water level. (PASS)

All conduits, panels, junction boxes that were visible for inspection appear good condition

Ground Rods:

Clamp on right side found loose, missing hardware, surface corrosion on rod

Need to disassemble clamps, wire brush rod and clamp to clean shiny metal, apply anticorrosion paste, reassemble and tighten



Coin-operated shore power pedestals:
(2 shown, others similar)

Every pedestal inspected found in disrepair

Tampering / vandalism evident

Most pedestals still contain live 120VAC wiring

Imminent shock hazard, possible arcing, fire hazard

Recommend immediate disconnection at the top of the nearby utility poles

Broken plastic conduits, exposed live 120VAC wiring
Missing meters and old junction boxes invite easy access for tampering

Preferred disconnection point is at the top of each utility pole

(Typical) Coin-operated shore power pedestals:

Every pedestal inspected found in disrepair

Tampering / vandalism evident

Most pedestals still contain live 120VAC wiring

Imminent shock hazard, possible arcing, fire hazard

Recommend immediate disconnection at the top of the nearby utility poles

Recommend complete removal of pedestals to prevent further tampering

South Side Meters and Service Disconnects:

Standard breakers do not meet NEC Article 555 requirement for GFCI breakers

Recommend replacing breakers with 30mA trip GFCI breakers

All electrical connections required to be at least 24" above maximum flood water level (PASS)

All electrical connections required to be at least 24" above maximum flood water level (PASS)

Steel Gantry Crane Near Fuel Dock / Sportfishing Office:

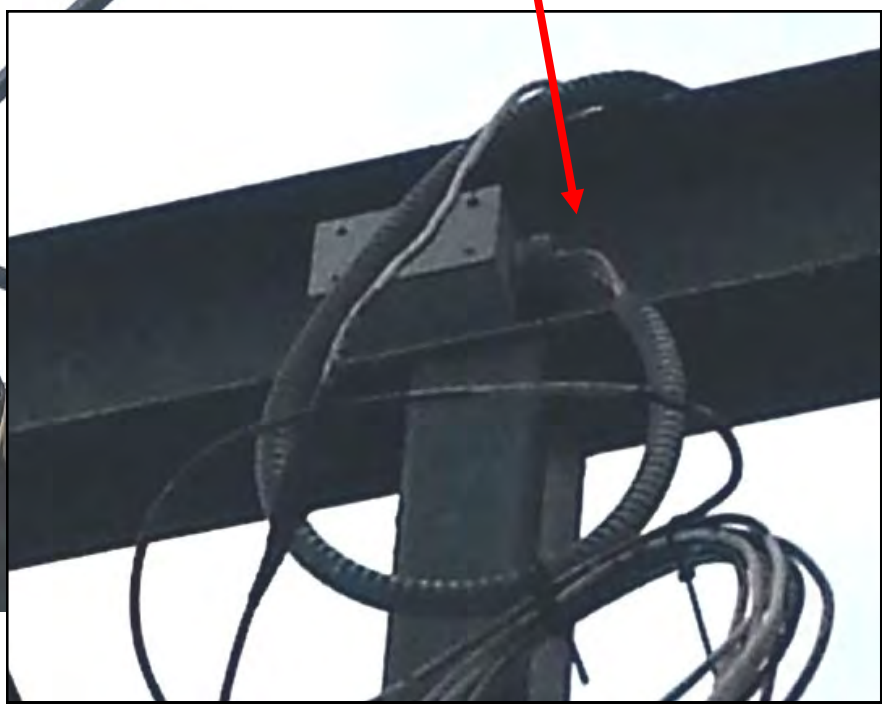
Broken conduit, exposed live 120VAC wires

Possible electrocution, fire hazard

Recommend immediate disconnection of supply circuit until repairs can be completed

DOES NOT MEET CODE

Recommend GFCI circuit breaker for crane power source



The location of the crane structure is right near the offloading site for diving / sportfishing guests

Several times during the inspection, guests were observed in wet, bare feet touching the crane uprights; imminent shock hazard

Recommend immediate disconnection of supply circuit until repairs can be completed

Fuel Dock / Sportfishing Office Patio Area:

Broken conduits, unsecured wiring

If conduit fails, it could fall directly onto patio / guest area

Possible shock, fire hazard

Patio area 120VAC receptacle:

DOES NOT MEET CODE

Loose, unsecured receptacle

Not equipped with GFCI receptacle

Located in area frequented by guests with bare, wet feet

Possible shock hazard

Below Deck 120VAC Dock Lighting:

(3 shown, all others similar)

All of the dock lighting junction boxes are below the minimum height requirements (2ft above highest tide level)

DOES NOT MEET CODE

All of the junction boxes that were inspected show signs of water ingress at high tide

Imminent shock hazard, if box fills with water while lighting circuits are energized

Possible arcing, fire hazard

Recommend immediate disconnection of all lighting circuits until repairs can be completed.

Boatowner - Installed shore power:

This installation near the Western end of the harbor is one of the few examples of a properly - installed shore power / load center

***GFCI breaker for boat recep.**

***Rain tight enclosure**

***GFCI receptacles**

***Proper 30A marine twist - lock receptacle with cover**

***except for the broken rain cover, this installation does appear to meet code**

30 Amp marine power cord, connected to small - gauge household indoor rated extension cord

Supplied by 30A breaker

Small - gauge cord will quickly melt or catch fire in the event of an overload

Possible fire, shock hazard

Boatowner - Installed shore power:

Household load center, feeding indoor - rated Romex cabling

Romex not rated for exposed applications

Romex cable not rated for exposure to UV, or high moisture applications

Possible fire, shock hazard

Boatowner - Installed shore power:

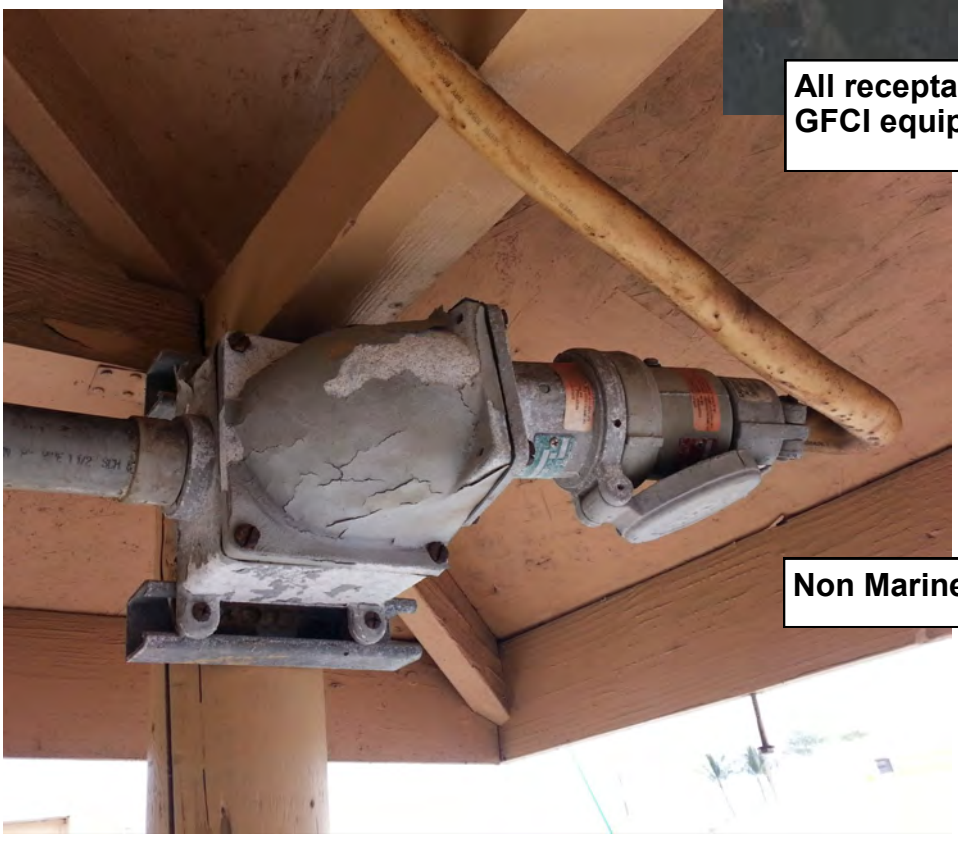
Non GFCI receptacles

Non Marine shore cord receptacle

Not equipped with GFCI breaker

DOES NOT MEET CODE

All receptacles in wet location must be GFCI equipped



Non Marine cord fittings and receptacle

Boatowner - Installed shore power:

Non GFCI receptacles

Non Marine shore cord receptacle

Not equipped with GFCI breaker

DOES NOT MEET CODE

All receptacles in wet location must be GFCI equipped

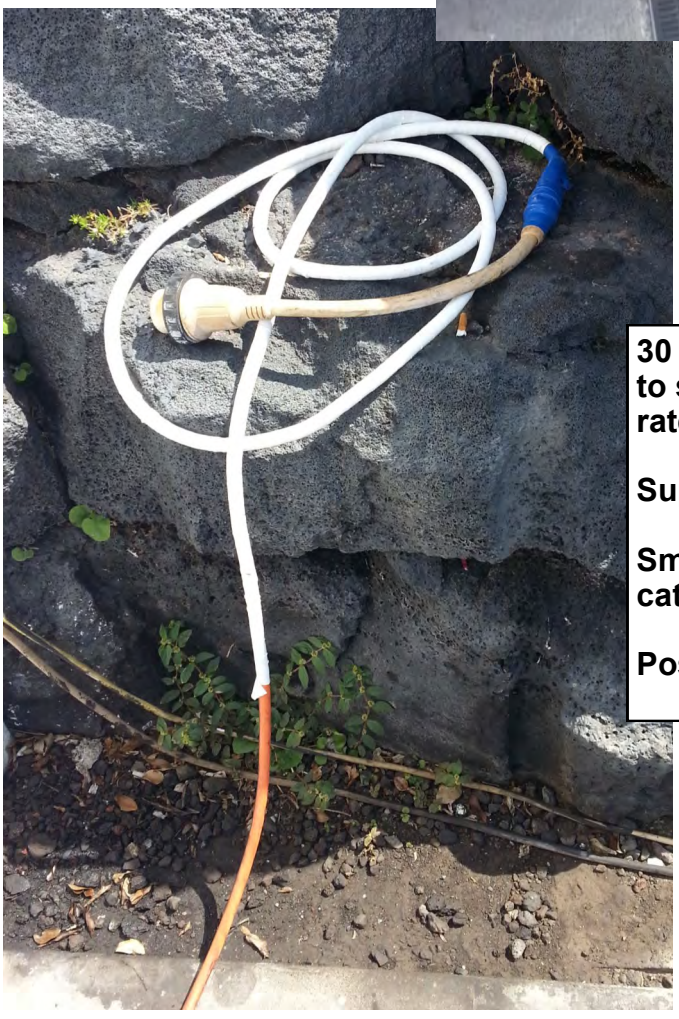
Missing, broken components

Possible arcing, fire hazard

Possible shock hazard

Boatowner - Installed shore power:

All electrical connections required to be at least 24” above maximum flood water level (DOES NOT MEET CODE)



30 Amp marine power cord, connected to small - gauge household indoor rated extension cord

Supplied by 30A breaker

Small - gauge cord will quickly melt or catch fire in the event of an overload

Possible fire, shock hazard

Concrete Causeway / Dock - Mounted Shore Power:

Numerous broken conduits

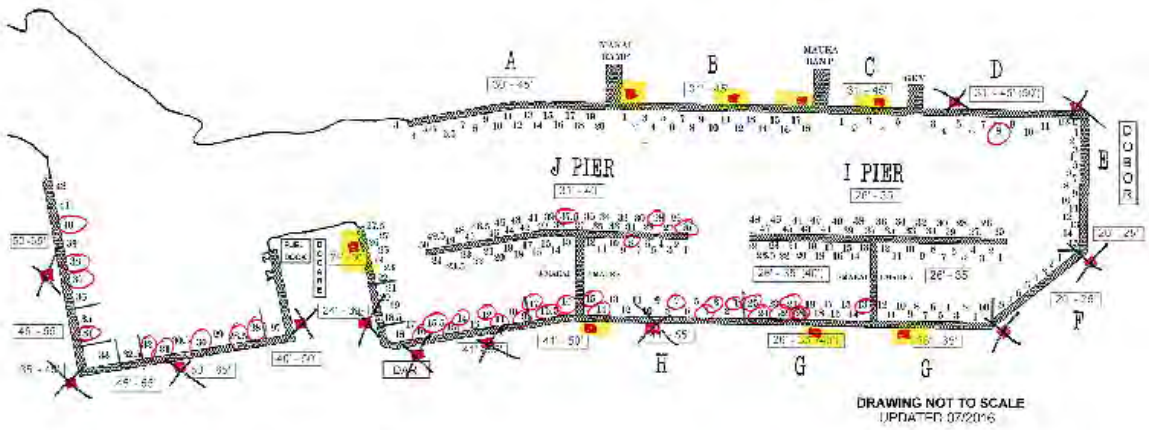
Missing, broken components

Non GFCI breakers

Possible shock, fire hazard

DOES NOT MEET CODE

HONOKŌHAU SMALL BOAT HARBOR
KAILUA-KONA, HAWAI'I



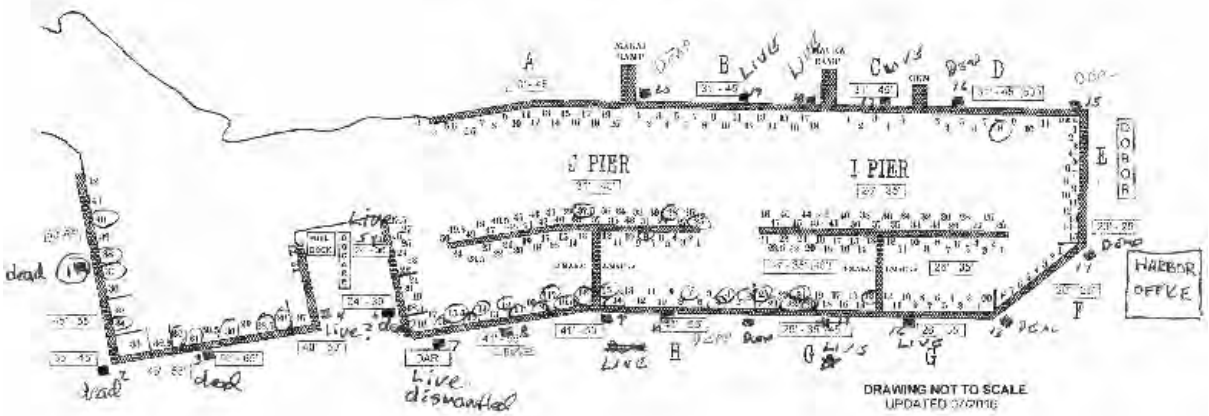
20 ■ - Electric coin meter

36 ○ - Privately metered electricity

■ = electrified works as it should OR on 24/7

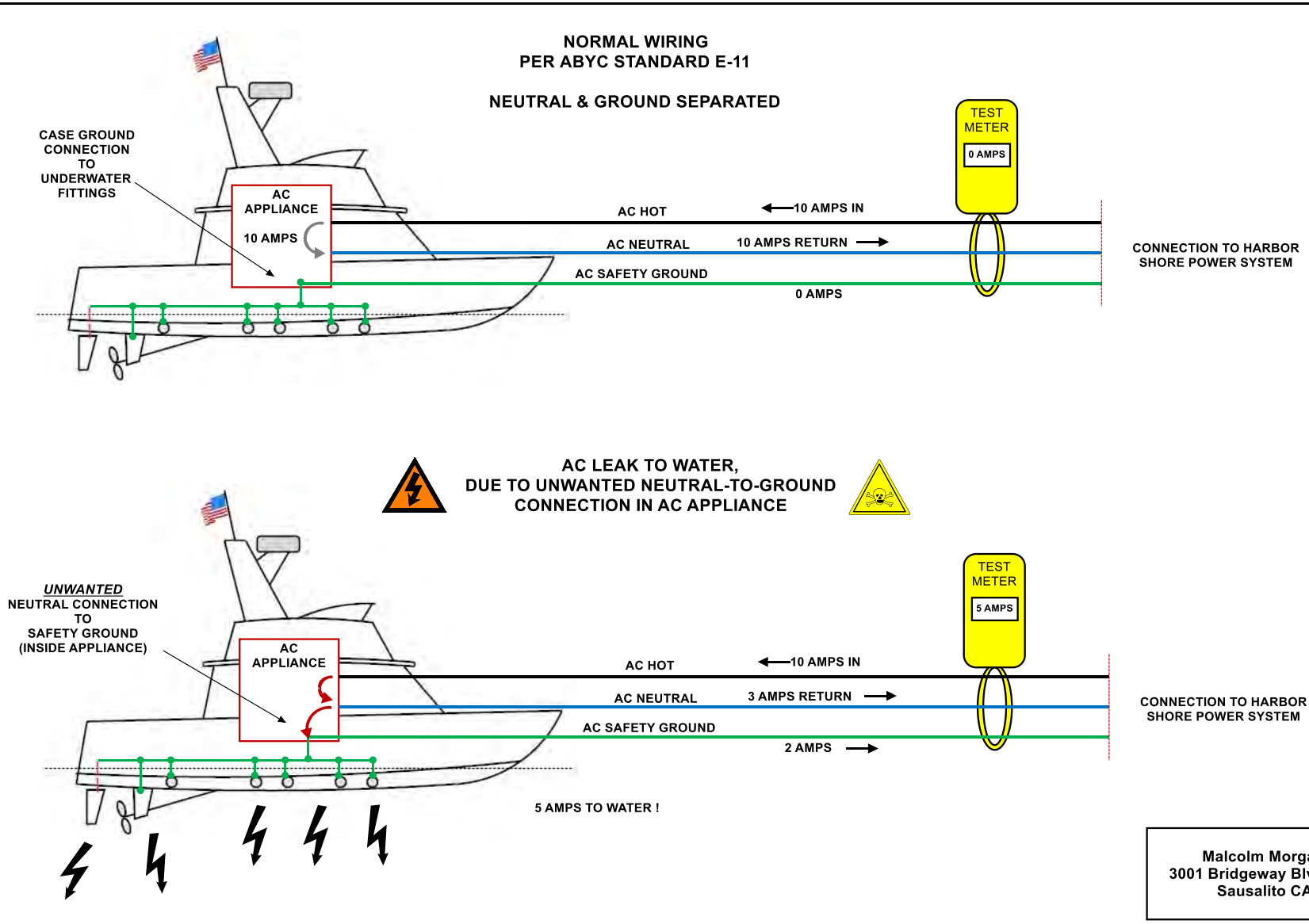
■ = doesn't work could still be electrified

HONOKŌHAU SMALL BOAT HARBOR
KAILUA-KONA, HAWAI'I



20 ■ - Electric coin meter

36 ○ - Privately metered electricity


NORMAL WIRING
PER ABYC STANDARD E-11
NEUTRAL & GROUND SEPARATED
CASE GROUND CONNECTION TO UNDERWATER FITTINGS
AC APPLIANCE
10 AMPS
TEST METER
0 AMPS
AC HOT
10 AMPS IN
AC NEUTRAL
10 AMPS RETURN
AC SAFETY GROUND
0 AMPS
CONNECTION TO HARBOR SHORE POWER SYSTEM
AC LEAK TO WATER,
DUE TO UNWANTED NEUTRAL-TO-GROUND
CONNECTION IN AC APPLIANCE
UNWANTED
NEUTRAL CONNECTION TO SAFETY GROUND (INSIDE APPLIANCE)
AC APPLIANCE
TEST METER
5 AMPS
AC HOT
10 AMPS IN
AC NEUTRAL
3 AMPS RETURN
AC SAFETY GROUND
2 AMPS
CONNECTION TO HARBOR SHORE POWER SYSTEM
5 AMPS TO WATER !
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Fire Hazards and Risk Factors From the Use of Household Extension Cords in Harbors and Marinas :

This information is provided for marina operators, port captains, and yacht clubs for risk / exposure analysis, or as a guideline in formulating electrical rules and regulations for berthholders.

Please feel free to use the following text or this document in whole as needed.

Fire Hazards and Risk Factors From Using Household Extension Cords in Harbors and Marinas :

The use of Non-Marine household extension cords to supply shore power to a vessel creates several hazards often overlooked until a problem occurs. The most significant problem is an increased risk of fire when using a small-gauge wire plugged into a 30 or 50 amp receptacle on the dock.

The NEC (National Electric Code) clearly defines the size & type of wiring that must be used for a given size circuit breaker, in order to ensure the breaker will trip off if there is a problem.
Here are 3 main issues to consider:

1. The wire size in the cord must match the size of the circuit breaker the wire is connected to. The dock 30 amp breakers WILL NOT trip if a small 16gauge or 18gauge cord is plugged into it. Even with a small load like a dehumidifier or battery charger, if there is an electrical fault or short circuit at the boat end, the small cord will not carry enough current to turn off the breaker; the cord simply overheats until it catches fire. This has been documented many times as the cause of a catastrophic fire.
2. The extension cords typically used are not made of corrosion proof materials, all of the prongs, receptacle blades, and even the wires are made from bare copper or plated steel, which quickly corrodes and causes excess heat to form. Even proper marine grade cord fittings suffer from corrosion, household cords fail at a much higher rate.
3. Most extension cords are not rated for constant outdoor exposure; particularly the outer insulation. While the outer jacket MAY last a year or 2, most typically do not, leaving the inner conductors exposed within a relatively short time.

If boatowners want to use an extension cord plugged into a 30 amp dock receptacle, the cord needs to have at least #10AWG conductors. A [30amp to 15 amp] unitized (1 part) adapter at the 'boat' end can be used to connect the 30 amp cord to the heater or charger. This is considerably safer than using a small cord plugged into a large breaker.

Another possibility for smaller vessels or race boats that do not want to use the heavy duty cord would be to request the harbor to install a 10 or 15 amp breaker in the dock box instead of the 30 amp breaker. This would at least reduce the risk of fire, and prevent overloading the small cord.

The requirement to prohibit the use of household extension cords has been forced upon both boatowners and harbors by insurance carriers in many cases. In addition, many harbors have been banning the use of [30 amp to 15 amp] or [50 amp to 30 amp] pigtail adapters, for the same reasons noted above. A 30 amp device plugged into a 50 amp breaker will overheat before the breaker trips.

The use of extension cords should be limited to temporary, attended use only, for power tools or other supervised applications; never for unattended or long-term use in a marina.

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